# CLAIMS

1. An inertial/global positioning system (GPS) receiver including:
   A. a GPS sub-system for providing correlation measurements and GPS observables associated with signals received from a plurality of GPS satellites;
   B. an inertial sub-system for providing inertial measurements from a plurality of accelerometers and gyroscopes;
   C. a clock that maintains GPS time;
   D. a processor for time-tagging the inertial measurements with the GPS time and calculating GPS position based on the correlation measurements and inertial position, velocity and attitude that are determined relative to the GPS position and are based on the inertial measurements and the GPS observables, the processor using
      - GPS position, associated covariance information and GPS observables to control the adverse effects in the inertial calculations of inaccuracies in the inertial sub-system measurements,
      - inertial position, velocity and associated covariance information to assist in signal re-acquisition operations of the GPS sub-system; and
      - inertial position and associated covariance information to assist in carrier cycle ambiguity resolution operations that are part of the signal re-acquisition operations.

2. The inertial/global positioning system receiver of claim 1 wherein the processor further calculates GPS position relative to a base receiver with a known position.

3. The inertial/global positioning system receiver of claim 2 wherein the processor
      - processes the GPS correlation measurements using one or more GPS filters, and
      - processes the inertial measurements and GPS observables using an inertial Kalman filter that updates previous and current position related

information and propagates current position, velocity and attitude related information.

4. The inertial/global positioning system receiver of claim 3 wherein the GPS observable is delta phase measurements.

5. The inertial/global positioning system receiver of claims 4 wherein the processor further

- determines when the receiver is stationary after initial movement, and
- when the receiver is stationary saves system components and performs a zero velocity update of the inertial Kalman filter using predetermined velocity values instead of velocity observational values.

6. The inertial/global positioning system receiver of claim 4 wherein

the inertial subsystem includes a distance measuring unit that provides distance measuring observables, and

the processor further uses the distance measuring observables in the inertial Kalman filter to update the previous and current position related information.

7. An INS/GPS receiver including:

A. an antenna for receiving signals from a plurality of GPS satellites;

B. a GPS sub-system for

acquiring and tracking the signals from the respective GPS satellites in view;

determining GPS position and related covariance information, and

producing associated delta phase measurements that are double differenced across both time and the GPS satellites,

C. an inertial measurement unit for making measurements associated with the acceleration and relative orientation of the receiver;

D. an INS Kalman filter that uses the inertial measurements and the delta phase measurements to update current and previous position related information and propagate current position, velocity and attitude related information; and

E. a mechanization task that determines inertial position, velocity and attitude based on the inertial measurements and the updated information produced by the INS Kalman filter.

8. The receiver of claim 7 further including

a distance measurement unit that provides a measurement that is associated with the distance traveled over a measurement interval; and

the INS Kalman filter further calculates an along track difference based on the measurement made by the distance measurement unit and a trajectory that is based on the inertial measurements over the same interval, the INS Kalman filter using the along track difference to update previous and current position related information and propagate current position, velocity and attitude.

9. A method of determining GPS position including:

A. receiving signals from a plurality of GPS satellites;

B. acquiring and tracking carriers and codes in the satellite signals and determining delta phase measurements;

C. determining GPS pseudoranges, Doppler offsets, and GPS position and covariance related information;

D. taking inertial measurements relating to acceleration and orientation;

E. updating inertial current and previous position related information using the inertial measurements, the GPS position and covariance related information, and the delta phase measurements;

F. propagating the updated current position information and velocity information; and

G. using the propagated position and velocity information to determine the current GPS position.

10 . The method of claim 9 further including

taking other observable measurements that correspond to distance traveled over a measurement interval; and

in the step of updating the inertial current and previous position related information, further using the other observable measurements in the updating of the current and previous inertial position related information.

11. A method of determining inertial position using an INS Kalman filter, the method including the steps of:

A. receiving from a GPS sub-system GPS position covariance information and GPS observables that over time measure position change;

B. making acceleration and attitude related inertial measurements;

C. using the observable and inertial measurements to update position information relating to a current position and a previous position and using the inertial measurements and the updated information to propagate current position, velocity and attitude related information;

D. using the propagated current position related information to determine an inertial position.

12. The method of claim 11 wherein, the GPS observable is carrier phase that is double differenced over both time and GPS satellites.

13. The method of claim 11 further including

making measurements and determining other observables that over time measure position change; and

including the other observables in the updating of previous and current position information.

14. The method of claim 13 wherein the other observable is wheel revolutions.